

What is claimed is:

1. A method of selecting input/output (I/O) devices to control power consumption of a computer system, the method comprising:
 - determining a power consumption metric for each of a plurality of I/O devices
 - 5 connected to the computer system;
 - selecting at least one of the plurality of I/O devices based on the determined power consumption metric; and
 - reducing power consumption of the at least one selected I/O device.
- 10 2. The method of claim 1, wherein selecting at least one of the plurality of I/O devices comprises:
 - identifying top power consuming I/O devices of the plurality of I/O devices based on the power consumption metric; and
 - selecting at least one of the top power consuming I/O devices to reduce power
 - 15 consumption.
3. The method of claim 2, wherein identifying top power consuming I/O devices of the plurality of I/O devices comprises:
 - estimating future power consumption for each of the plurality of I/O devices for a
 - 20 period of time in the future; and
 - selecting a group of the plurality of I/O devices having the highest estimated future power consumptions.

4. The method of claim 2, further comprising:
identifying low-power I/O device alternatives to using the top power consuming I/O devices.
5. The method of claim 4, wherein the low-power alternatives comprise at least one of placing a top power consuming I/O device in a low-power mode and disabling a top power consuming I/O device if an I/O device providing substantially the same functionality and consuming less power is available for use.
6. The method of claim 4, wherein identifying low-power I/O device alternatives comprises:
using a usage model to determine whether any low-power I/O device alternatives to using the top power consuming I/O devices are available, the usage model including a historical analysis of usage for the plurality of I/O devices.
7. The method of claim 6, wherein the usage model identifies user acceptance of the low-power I/O device alternatives.
8. The method of claim 4, further comprising:
determining power savings for each of the low-power I/O device alternatives.

9. The method of claim 8, wherein determining power savings comprises:
estimating a first future power consumption for a top power consuming I/O device
operating in a normal mode;
estimating a second future power consumption for a respective low-power I/O
5 device alternative; and
determining a difference between the first and second future power consumptions.
10. The method of claim 8, wherein selecting at least one of the plurality of I/O
devices based on the determined power consumption metric comprises:
10 selecting at least one of the top power consuming devices based on user
acceptance and power savings of a low-power I/O device alternative to the at least one top
power consuming I/O device.
11. The method of claim 10, wherein selecting at least one of the top power
15 consuming devices comprises:
selecting a plurality of the low-power I/O device alternatives associated with the
top power consuming I/O devices;
ranking the plurality of low-power I/O device alternatives based user acceptance
and power savings for each of the plurality of low-power I/O device alternatives; and
20 selecting at least one of the plurality of low-power I/O device alternatives based on
the ranking.

12. The method of claim 1, wherein selecting at least one of the plurality of I/O devices comprises selecting at least one of the plurality of I/O devices based on the determined power consumption metric and based on a usage metric for each of the plurality of I/O devices.

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13. The method of claim 12, wherein the power consumption metric comprises at least one of estimated power consumption of the plurality of I/O devices, estimated future power consumption of the plurality of I/O devices, an aggregate of the power consumption of each of the I/O devices, power consumption of the computer system, estimated future
10 power consumption of the computer system, and a power savings for each of the I/O devices if a respective I/O device were placed in a low-power mode.

14. The method of claim 12, wherein the usage metric comprises a metric associated with user acceptance of placing an I/O device of the plurality of I/O devices in a low-
15 power mode.

15. The method of claim 1, wherein the power metric comprises an estimated future power consumption and the step of selecting comprises:
determining recent use of each of the plurality of I/O devices;
20 estimating future power consumption based on the recent use for each of the plurality of I/O devices; and
selecting at least one of the plurality of I/O devices based on the estimated future power consumption.

16. The method of claim 1, further comprising:
identifying a setting associated with one of the plurality of devices, wherein the
setting specifies a constraint on reducing power consumption for the one of the plurality of
I/O devices; and
5 the step of reducing power consumption comprises reducing power consumption
of the one of the plurality of I/O devices if the constraint specified in the setting can be
maintained.
17. The method of claim 16, wherein the setting comprises a setting specified by a
10 user.
18. The method of claim 1, further comprising:
profiling usage of each of the plurality of I/O devices;
generating a usage model from the profiling; and
15 the step of selecting comprises selecting at least one of the plurality of I/O devices
based on the usage model.
19. The method of claim 18, wherein profiling usage comprises:
analyzing recent usage behavior of at least one of the plurality of I/O devices for a
20 given user.
20. The method of claim 18, wherein profiling usage comprises:

analyzing past usage behavior of at least one of the plurality of devices for a plurality of users.

21. The method of claim 1, further comprising:

- 5 profiling power consumption of each of the I/O devices;
 generating a power model from the profiling; and
 the step of selecting comprises selecting at least one of the plurality of I/O devices based on the power model.

- 10 22. The method of claim 1, wherein the power consumption metric comprises at least one of estimated power consumption of the plurality of I/O devices, estimated future power consumption of the plurality of I/O devices, an aggregate of the power consumption of each of the I/O devices, power consumption of the computer system, estimated future power consumption of the computer system, and a power savings for each of the I/O
15 devices if a respective I/O device were placed in a low-power mode.

23. A method of controlling power consumption of I/O devices for a computer system, the method comprising:

- profiling usage patterns of the I/O devices to establish a usage model;
20 identifying low-power alternatives to using at least one of the I/O devices using the usage model;
 profiling power consumption of the I/O devices to establish a power model;

selecting at least one of the low-power alternatives to reduce power consumption of the computer system based on the power model.

24. The method of claim 23, wherein the low-power alternatives comprise at least one
5 of placing an I/O device in a low-power mode and disabling an I/O device if another I/O device providing substantially the same functionality and consuming less power can be used.

25. The method of claim 23, further comprising:
10 determining whether a power consumption of the computer system or an estimated future power consumption of the computer system exceeds a threshold; and
performing the step of identifying low-power alternatives and the step of selecting at least one of the low-power alternatives in response to the threshold being exceeded.

15 26. An apparatus comprising:
means for identifying a plurality of low-power alternative means to using an I/O device connected to the computer system using a usage model; and
means for selecting at least one of the low-power alternatives means to reduce power consumption of the computer system using a power model.

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27. The apparatus of claim 26, wherein the low-power alternative means comprises means for providing substantially the same functionality of the I/O device at reduced power consumption.

28. The apparatus of claim 26, further comprising:

means for determining whether a power consumption of the computer system or an estimated future power consumption of the computer system exceeds a threshold; and

means for activating the means for selecting a plurality of low-power alternative

5 means and the means for selecting at least one of the low-power alternatives means in response to the threshold being exceeded.

29. Computer software embedded on a computer readable medium, the computer software comprising instructions of:

10 determining a power consumption metric for each of a plurality of I/O devices connected to a computer system;

selecting at least one of the plurality of I/O devices based on the determined power consumption metric; and

reducing power consumption of the at least one selected I/O device.

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30. The computer software of claim 29, wherein the instruction of selecting at least one of the plurality of I/O devices comprises instructions of:

identifying top power consuming I/O devices of the plurality of I/O devices based on the power consumption metric; and

20 selecting at least one of the top power consuming I/O devices to reduce power consumption.

31. The computer software of claim 30, further comprising an instruction of:
determining whether any low-power I/O device alternatives to using the top power
consuming I/O devices are available.
- 5 32. The computer software of claim 31, further comprising an instruction of:
determining power savings for each of the low-power I/O device alternatives.
33. The computer software of claim 32, wherein the instruction of selecting at least
one of the plurality of I/O devices comprises an instruction of:
10 selecting at least one of the top power consuming devices based on user
acceptance and power savings of a low-power I/O device alternative to the at least one top
power consuming I/O device.
34. A computer system comprising:
15 a processor; and
a battery, wherein the processor is operable to determine a power consumption
metric for each of a plurality of I/O devices connected to the computer system, select at
least one of the plurality of I/O devices based on the determined power consumption
metric, and control the at least one selected I/O device to reduce power consumption in
20 response to remaining battery life falling below a threshold.